Exploiting
Information Systems
for Effective Management

MIKE WRIGHT & DAVID RHODES

Manage IT!

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Preface

The emphasis in most discussion of Information Technology (IT) to date has focused on the relative capabilities of the myriad of hardware and software involved. There is a sad delusion that as long as the IT works technically and reliably the system is a success. So it may be on one level. But there may also be serious problems in that the recently acquired IT may not really be doing the job it was supposed to do, that the job is the wrong one in the first place, and that employees in the organization may be by-passing the system for one reason or another. These are essentially problems concerned with the management of the introduction of IT. Such problems have tended to be ignored or at least trivialized. Part of the reason is probably that many of those involved with the introduction of IT in companies are perhaps interested in the more precise area of computing rather than in the more nebulous area of management. A second reason lies in the perspective of managers who believe, or who are led to believe, that IT is the answer to all their problems without understanding its implications. It is to try and rectify what we see as an imbalance that we have written this book.

The work from which this book is drawn is based on the collaborative efforts of two authors from very different disciplines. One of us, David Rhodes, is by background an electrical engineer, whilst the other, Mike Wright, is an industrial economist and accountant. That it took at least a year before each understood what the other was saying illustrates the problem of integrating different approaches, which is a major theme of the book.

In writing the book we have benefited greatly from

discussions with colleagues, fellow academics, managers and employees in a variety of organizations. Particular thanks for helpful insights go to Gerry Waterlow, Maurice Bonney, and Charles Snyder. Grateful thanks are also extended to the managers and employees in the organizations which appear in the case studies.

Christine Waddon and Louise Wallace are to be commended for their ability to convert our manuscript into and out of electronic signals on a floppy disc. We acknowledge also the Institution of Electrical Engineers for providing several of the examples in Chapter 8.

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Introduction

A report in Fortune in September 1982 estimated that over 60 per cent of microcomputers sold in American stores were purchased for business use. However, many purchasers were unable to make full use of the machines' capabilities because of their lack of expertise. An earlier study by the International Machine Tool Task Force published in 1980 and sponsored jointly by the US Airforce and the Society of Manufacturing Engineers demonstrated that the low utilization rates of machine tools was primarily due to poor management and organizational problems. On a wider front, a 1982 survey in the United Kingdom, indicated that more than 80 per cent of the population had heard of IT (Information Technology), but what they actually understood by the term was not established. However in 1985 a Mori Poll found that only 43 per cent of a sample of 1.824 interviewees did understand the term.

This evidence, from different quarters, illustrates the problem that, despite a high level of awareness of IT and enthusiasm for it, in reality IT is poorly perceived. Obtaining the best results from IT goes far beyond anything to do with the capabilities of the technology itself. Education in technology must come before an explanation, but the technical facts are only a small part of the story. Although the survey results just quoted are now dated, the problem that they highlight is still with us. There are still very few accounts of how people and IT might learn to co-exist, of where the fundamental opportunities and difficulties lie, or of how and when to innovate. Most writing is about 'hightech' products for a particular purpose. The 'ways and means' of assimilating change are sadly neglected, and it is

to this aspect of IT that the book addresses itself. The ways and means of assimilating change are in practice usually very narrowly defined. As one researcher in the area has remarked:

"Most organisations believe that they have successfully implemented new operating technology when two conditions are met. First, when all the bugs have been ironed out and that it is working technically. Second, when the operation is working reliably . . . however, when you probe beneath the surface, one must question the success of 'successful systems'."

Drawing on case studies carried out in the United Kingdom, United States and Australia, Voss (1985) concludes that the weight of evidence indicates that failure to realize the full benefits of new manufacturing technologies occurs principally because they are managed in traditional ways which are inappropriate, because there is a failure to manage the learning process and because there is a failure to manage the work-force appropriately. Although Voss was referring specifically to new manufacturing technologies, the problems he highlights are relevant to IT generally, since a Mori poll in 1982 showed that 90 per cent of businessmen thought IT would make their company more productive and competitive.

In developing an approach to how to introduce IT it is necessary first to understand what is meant by IT, and secondly why a firm should seek to introduce it.

What is IT?

Information technology is a recent term used to describe any equipment or mechanism involved in the processing, storage, display or communication of information or data. Its importance is perhaps less in the definition, which is reasonably obvious, than in the fact that such a word is important enough to be added to the general vocabulary. Papyrus, clay tablets, quill pens and ink are examples of IT, so too are signal flags and semaphore. Between them they cover the aspects referred to above of storing, displaying and communicating. Writing both stores and displays, flags display and communicate. In terms of quantity, writing, for example, stores typically 350 words per page or tablet, and Nelson's flags, with the help of an extensive book of reference codes, can convey a few sentences per hour. By today's standards, they are a poor means of communication, and contain little evidence of the other ingredient of IT, that is, processing power.

In stark contrast, modern IT is revolutionary. It has considerable processing power, independent of human intervention. This was created by the invention of the transistor in 1948 and the subsequent development of manufacturing processes which permit many such devices to be assembled on a single chip of semiconductor, typically in excess of 20,000 per square centimetre. The processing ideas already developed theoretically and evident to some extent in large, costly and mostly unreliable equipment containing electronic valves were, at the time of these inventions, available for immediate exploitation. This gave impetus to the revolution because the new technology was not only several orders of magnitude smaller but also cheaper and more reliable. The increased market for electronics goods also brought competition and economies of scale to reduce costs and price further. But, revolutionary though the effects may be, they are consistent with normal technical developments, well illustrated in history. Semaphore became the telegraph when electricity was used to transmit one piece of information by wire. The telegraph evolved progressively into the telephone, radio, radar, television, satellite communications and cable television as improvements in the theory of electromagnetic radiation were supported by better and cheaper equipment with more and more processing power. A laser printer can read, process and print 20,000 characters per second, while a television screen displays approximately a million items of information every 1/50th of a second. Each item is processed in that time by the camera, transmitter, receiver and screen!

Modern computers are practical achievements with dramatic improvements (Table 1.1). The ideas of Babbage, Turing and Von Neumann, on which they are based, have been around for a long time, so the recent success is due to the computer being both a cheap and effective solution. Initially, integrated circuits made the microcomputers possible, but recently the development of reliable disc drives to store information at relatively low cost (10 Mbytes per £1,000) has been a more important factor.

Table 1.1 Twenty-five years of computer engineering: a comparison

Year	1959	1984
Machine	Pegasus	ICL personal computer
Status	Medium performance/cost (smaller of a range of two)	Low performance/cost (smallest of range)
Price	£750,000 approx., 1984 prices	From £2,000
Central processor	375 packages	1 card
Working store	105 packages - 1000 bytes	1 card = 250,000 bytes
Permanent store	Magnetic drum = 42,000 bytes Magnetic tape = 100,000 bytes (12 in diameter + 0.5 in)	5¼ in floppy disc -500,000 bytes
Preventive maintenance	Check all components every 2 years	None needed
Engineering support	1 engineer resident, half-time	Take it to a service centre
Typical environment	Air-conditioned computer room	Desktop anywhere
Performance	3000 instructions per second	1 million instructions per second
Power consumption	13.5 kW	280 W
Weight	900 kg	16 kg
Number sold	40	Thousands

Source: J. M. Watson, 'The Technology that Makes IT Possible', Electronics and Power (house journal of the Institution of Electrical Engineers), January 1985, p. 15.

There are other areas of mechanical rather than electronic achievement. Most printers can produce at least as many lines a second as a typist can produce words, and some printers can produce as many pages. There are also the ubiquitous copying machines and many thousands of machine tools which, instead of being worked by hand, are controlled by programs. This is a very significant point. Not only are computers powerful processors (hardware) but through the use of programs (software) that processing power may be used very flexibly. In this way the same computer can be used for a wide variety of tasks. Software is crucially important; its value is in the flexibility it brings to processing power. Modern telephone exchanges, example, are computers with programs to control the interconnections and flow of calls. They are no longer buildings full of switches. Without software IT might not exist. It would certainly be a pale shadow of its current self.

Why IT?

The research by Voss, quoted earlier, suggests that a typical rationale for the introduction of IT goes something like 'We have a (fill in blank space) problem, computers are used for solving (fill in blank space) problems, therefore we shall buy a computer and solve our (fill in blank space) problem'. This kind of statement is reminiscent of those heard some years ago when main-frame computers were first introduced. It seems a lot has been learned on the technical side. but not much from the managerial point of view.

In essence, the question 'Why IT?' really leads right back to what the business is about. To some extent. commercial organizations are about surviving in a competitive, changing environment. The first role of IT is, therefore, in contributing to the firm's ability to remain in business in such circumstances. An excellent example of the way in which IT can make a substantial contribution to competitiveness emerges from a comparison of the experiences of regional and national newspapers in the United Kingdom.

A provincial newspaper, the Nottingham Evening Post, installed the most modern equipment available in 1974 and has continued to keep it up-to-date. There are ten editions of the paper per day and the company also produces weekly papers for eleven other towns. The type-setting and textediting equipment is under-utilized, and the company thus does a large amount of sub-contract work with little additional overhead. The company is profitable, a business success and well-known nationally.

In London, to the present day, The Times and several other famous newspapers are prepared and printed with obsolete machinery. Each requires about three times as many operators, at considerably higher salaries, as their provincial counterparts. A type-setter in London, using vestervear's technology, earns considerably more than a professor of computer science for a job which a moderately trained teenager could do with ease on modern equipment. The London papers are not profitable and are subsidized by entrepreneurs who have made their fortunes in other fields. There have been serious attempts to modernize the papers and several strikes to obstruct the process. The Times was closed for many months on one occasion over such a dispute. The owner of Mirror Group newspapers, Robert Maxwell, threatened that the Group would have to close if serious over-manning is not removed and replaced by the introduction of IT. It has taken the threat of an imminent new national newspaper to be produced 80 per cent cheaper to obtain this reaction (whether Robert Maxwell will be able to put the change into effect remains to be seen). Information technology promotes competitiveness in terms of cost reductions with large-volume outputs (economies of scale). But the savings can be wider. As the Nottingham Evening Post illustrates, it may also become worthwhile to produce different products on the same

equipment (economies of scope), because of the flexibility that IT affords. Such economies of scope and scale may also be available to manufacturing industry in general. In addition, IT may also help competitiveness by reducing lead and delivery times, reducing the carrying costs of stocks (through being able to cope with less stock) and by increasing quality and reducing scrap and waste (reductions in inspection costs may also accompany these types of savings).

On a wider front, the introduction of IT has implications for the success of whole sectors of industry. Very few companies, if any, are so arranged that they are independent of outside suppliers or sell all their produce within the company. They, therefore, depend to some extent both upon their suppliers' ability to provide goods efficiently and cheaply and upon the continued purchase of their goods by customers who are themselves manufacturing companies and who eventually sell to the end-user. A kind of 'foodchain' arrangement may be said to exist ranging from raw material suppliers at one end to end-users at the other. Suppliers of goods to other companies further along the chain are vulnerable if any of the organizations between them and the end-user becomes so inefficient that the market is lost. The loss of markets, particularly by companies towards the final-user end of the chain, is most likely to have a domino effect on their supplier firms. Such has been the experience in the United Kingdom, at least, for a number of years.

The benefit of IT in helping bring lower cost products to market derives not just from the actual machine operations that produce the goods but also from the influence of better co-ordination of the activities or their integration. Integration is something much talked about, little specified, little understood and even less achieved. If a company is represented as a three-dimensional set of activities, with senior management down to shop-floor employees as one axis, each function as another axis and each product or division

as the third axis, then it is clear that integration involves vertical, horizontal and perhaps diagonal co-ordination of activities. It is a mistake to restrict integration to one of the dimensions only and a great deal of the attention that has been paid to the introduction of IT has tended to follow a unidimensional approach. Indeed, there are often formidable problems to be overcome in achieving even this degree of integration. But, although those who do achieve it are to be commended, there are also dangers inherent in this method. As an extreme, but illustrative example, IT might be introduced in the production of product X, enabling sales, the various departments in the stages of production and accounts to communicate with each other so that X is produced on time for customers and the sales revenue is also collected on time. However, this set of activities could be incompatible with the more strategic objectives of the business. For example, despite this achievement the firm could still be bankrupt. The integrational use of IT may quite conceivably depress the firm's performance rather than improving it.

The how of IT

Actually realizing the potential benefits of IT described in the previous section is not easy. In many cases where IT has been introduced, reliance has been placed upon a computer package to which the organization has subsequently had to adapt. But, adaptation is often not practical and the IT is then badly used or abandoned. Where specially designed computer programs have been introduced their degree of success may be marred by inadequate assessment of why IT is being introduced. What should be clear, therefore, is that the form of IT adopted should be appropriate to the circumstances facing a particular organization.

Thus, in deciding on how to manage the introduction of IT (which includes the decision *not* to do so) an organization

needs to be able to assess its circumstances in a structured and coherent manner. Such an approach requires asking questions about the organization's relationship with its environment and about the organization's internal structure and workings. For both of these aspcts, change is an important element in the assessment procedure. Consideration of change involves not only the manner and speed of change of the external environment, but how the organization usually deals with change. It needs to be asked whether the normal means of dealing with change are appropriate for the change involved in the introduction of IT. An important element in coping with change is the nature of resistance to change and how that resistance is handled. Explicit analysis of the implications of change may enable it to be seen as presenting opportunities to achieve objectives rather than simply as a threat.

Dealing with the issues

To deal with the issues surrounding management of IT, we begin with a general treatment of the problems of dealing with change and develop the discussion into practical guidelines for those companies facing the introduction of IT.

Contrary to some popular belief, change produced by IT is not the first that has occurred in industry, nor is it the unique occasion on which change has been rapid. Chapter 2 sets out the nature of change, what is known about the way in which companies handle it, and why resistance to change might occur. Attention to these issues can enable managers of organizations to see change as offering not a threat but many opportunities. This discussion, therefore, addresses the way in which firms deal with the change involved with the introduction of IT, and these are taken up in detail in Chapter 3. In particular, Chapter 3 sets out a general framework for the management of the introduction

of IT, including dealing with resistance to change. Within this framework the integration of activities afforded by IT is viewed on a multi-dimensional basis and it is shown that a firm has a choice of ways in which it can deal with IT. The need is to adopt an approach suitable for the particular firm in question. Chapter 4 develops the preceding two chapters to provide a practical procedure which allows the management of a firm to identify the appropriate route to the introduction of IT, and a methodology for carrying it out. The remaining chapters of the book, apart from the last one, provide detailed case study material which shows how the methodology developed earlier might be used in practice. The first case study chapter (Chapter 5) illustrates misguided shortcuts and failures and shows how the methodology can help identify problem areas. The second case study chapter (Chapter 6) deals with the more detailed aspects of systems analysis and design and demonstrates a more successful application where major problems of integration are involved. The final case study chapter deals with a different type of organization than the other case material. The introduction of IT in a hospital in the British National Health Service illustrates the issues and problems involved where the pressure to change is not from a rapidly changing competitive environment, in an organization whose management styles emphasize a different aspect of integration than that found in commercial firms. In the British National Health Service, line management authority is not a strong feature of the organizational structure, although there have recently been proposals to strengthen it. The main thrust of management style is consensus management which focuses on agreement between the nursing, medical and administrative professions at each level in the organization, on what is to be done. Horizontal integration is thus emphasized at the expense of vertical coordination. In making the comparison between these types of organizational style the importance of a multidimensional approach to integration is highlighted. The

circumstances of the introduction of IT, namely well-publicized concern about the nature of patient care, also illustrate the opportunity provided by environmental factors in provoking change.

In all the case material a common unifying thread is clear. Since effecting the changes involved in introducing IT is often complex, in terms both of the technology itself and of the managerial issues, a need for an agent of change is apparent. This catalyst may come from either inside or outside the company, but in either case must have the authority to effect change and have the support of those for whom the change is intended.

The final chapter is rather more speculative in nature than the rest of the book, as it attempts to identify future trends in the introduction of IT. Emphasis is both on the side of the technology itself and on the management issues involved.

Reading this book

This book aims to assist all those who are interested in the introduction of IT into an organization. As such, there are parts of the book which are more likely to appeal to some readers rather than others. Those involved in the introduction of IT in their own companies are likely to find Chapters 4 to 7 of most practical relevance.

For those concerned with the more general issues of how organizations deal with change and with that concerning IT in particular, Chapters 2, 3 and 8 are recommended starting points. The book has, however, been written as an integrated whole (given that integration is a major theme in the book, it would be rather cowardly of us if it were not). It is hoped that readers approaching the subject from differing perspectives will gain something positive from the bringing together of the general and practical aspects involved in managing the introduction of IT.